

Newcastle Disease

Importance

Newcastle disease produces a wide range of clinical signs in avian species, from mild to severe. Exotic Newcastle disease (END), the most severe form with neurologic and gastrointestinal signs, is not endemic in the United States. Frequent outbreaks do occur in the U.S. due to illegal importation of exotic birds. The disease is highly contagious and can have high mortality rates. Chickens are highly susceptible and economic losses can be significant.

Etiology

Newcastle disease viruses are classified in the serotype group avian paramyxovirus type 1 (APMV-1) in the genus *Rubulavirus*, family *Paramyxoviridae*. There are nine avian paramyxovirus serotypes designated APMV-I to APMV-9.

Species affected

Many avian species are affected by Newcastle disease viruses. Of poultry, chickens are the most susceptible, ducks and geese are the least. Inapparent infections and carrier states can occur in psittacine and some wild bird populations.

Geographic distribution

Exotic Newcastle disease is endemic in many parts of the world including countries in Asia, the Middle East, Africa, and Central and South America. Some countries in Europe are free of the disease. The United States and Canada have seen high mortality in wild cormorants caused by END. There was an outbreak of END in the US in 2003 in southern California.

Transmission

Transmission can occur by direct contact with feces and respiratory discharges or by contamination of the environment including food, water, equipment, and human clothing. Newcastle disease viruses can survive for long periods in the environment, especially in feces. Generally, virus is shed during the incubation period and for a short time during recovery. Some psittacine species can shed the virus intermittently for a year or more. Virus is present in all parts of the carcass of an infected bird.

Incubation period

The incubation period for Newcastle disease can vary from 2-15 days depending on the severity of the strain and the susceptibility of the population. In chickens with the velogenic form, an incubation period of 2-6 days is common.

Clinical signs

Newcastle disease virus strains used to be grouped into pathotypes based on their clinical signs and virulence. These pathotypes included: asymptomatic enteric, which is generally subclinical; lentogenic or respiratory, which has mild or subclinical respiratory signs;

mesogenic, which has respiratory and occasional neurologic signs with low mortality; and velogenic, which is the most virulent pathotype with high mortality rates. The velogenic pathotype is divided into a neurotropic form, which has respiratory and neurologic signs, and a viscerotropic form with hemorrhagic intestinal lesions. This classification is not always that clear-cut and many strains have varied manifestations in different birds. In addition, less pathogenic strains can produce severe clinical signs depending on secondary infections or environmental factors.

The OIE provides a clearer definition for the reporting of any case of Exotic Newcastle as: “Newcastle disease is defined as an infection of birds caused by a virus of avian paramyxovirus serotype 1 (APMV-1) that meets one of the following criteria for virulence:

- a. The virus has an intracerebral pathogenicity index (ICPI) in day-old chicks (*Gallus gallus*) of 0.7 or greater.

Or,

- b. Multiple basic amino acids have been demonstrated in the virus (either directly or by deduction) at the C-terminus of the F2 protein and phenylalanine at residue 117, which is the N-terminus of the F1 protein. The term ‘multiple basic amino acids’ refers to at least three arginine or lysine residues between residues 113 and 116. Failure to demonstrate the characteristic pattern of amino acid residues as described above would require characterization of the isolated virus by an ICPI test.”

More specific clinical signs that can be seen with END, particularly in chicken flocks, include an initial drop in egg production followed by numerous deaths within 24-43 hours. Deaths in the flock may continue for 7-10 days. Birds that survive for 12-14 days usually live but may have permanent neurological damage including paralysis, and reproductive damage causing decreased egg production. Viscerotropic strains may cause edema of the head, especially around the eyes, and greenish-dark watery diarrhea. Respiratory and neurological signs can also be seen, though these are not as severe as with the neurotropic form. The neurotropic strains cause respiratory signs of gasping and coughing followed by neurological signs which may include muscle tremors, drooping wings, dragging legs, twisting of the head and neck, circling, depression, inappetence, or complete paralysis. There is generally no diarrhea with the neurotropic form. Clinical signs associated with the various strains can be different in species other than chickens. Psittacines and pigeons may show neurologic signs when infected with the viscerotropic strain. Finches and canaries may show no signs of disease at all. Vaccinated birds will have less severe signs.

Post mortem lesions

There are no specific diagnostic post mortem lesions seen with Newcastle disease. A tentative diagnosis can be made with the examination of several carcasses. Gross lesions

can be very similar to highly pathogenic avian influenza; therefore, laboratory isolation and identification is important in definitive diagnosis. Lesions may include edema of the interstitial tissue of the neck, especially near the thoracic inlet, and congestion and sometimes hemorrhages on the tracheal mucosa. Petechiae and small ecchymoses may be found on the mucosa of the proventriculus, especially around the orifices of the mucous glands. Additional lesions may include edema, hemorrhages, necrosis, or ulcerations of lymphoid tissue in the intestinal wall mucosa (including Peyer's patches), as well as edema, hemorrhages, or degeneration of the ovaries.

Morbidity and Mortality

Morbidity and mortality rates can vary greatly depending on the virulence of the virus strain and susceptibility of the host. Environmental conditions, secondary infections, vaccination history, and host species all affect these rates. In chickens, morbidity can be up to 100% with 90% mortality. In other species such as finches and canaries, clinical signs may not be present.

Diagnosis

Clinical

Newcastle disease may be suspected, especially in chicken flocks, with a sudden decrease in egg production, high morbidity and mortality, and the characteristic signs and gross lesions; however, due to the wide variety of signs and similarities to other avian diseases, particularly fowl cholera and highly pathogenic avian influenza, definitive diagnosis requires virus isolation and identification in the laboratory.

Differential diagnosis

Differentials include fowl cholera, highly pathogenic avian influenza, laryngotracheitis, coryza, fowl pox (diphtheritic form), psittacosis (chlamydiosis in psittacine birds), mycoplasmosis, infectious bronchitis, Pacheco's disease (seen in psittacine birds), as well as management problems such as deprivation of water, feed or poor ventilation.

Laboratory tests

Samples for virus isolation are inoculated into 9-11 day old embryonated chicken eggs. Chorioallantoic fluid of dead embryos can then be tested for hemagglutination activity and hemagglutination-inhibition. Further tests may be performed to determine pathogenicity and virus strain. Tests available for serology include hemagglutination-inhibition and enzyme-linked immunosorbent assay (ELISA). Vaccination and previous exposure to disease may affect serology results.

Samples to collect

Before collecting or sending any samples from animals with a suspected foreign animal disease, contact the AVIC. These samples should only be sent under secure conditions, by authorized personnel, and to authorized laboratories to prevent the spread of disease. Newcastle disease is zoonotic; samples should be collected and handled with all appropriate precautions.

Swabs can be taken for virus isolation from the trachea and cloaca of live birds, or tissue samples from dead birds including trachea, lung, spleen, cloaca and brain. Feces can also

be used for culture. Cell culture broth such as brain and heart infusion broth with high levels of antibiotics should be used for transport. Samples may be pooled in one broth tube if multiple animals are to be tested. Culture tubes should be kept on ice if they will reach the laboratory within 24 hours; otherwise the samples should be quick-frozen and not allowed to thaw during transport. Clotted blood or serum samples can be submitted for serology.

Recommended actions if Newcastle Disease is suspected

Notification of authorities

State and federal veterinarians should be immediately informed of any suspected cases of Newcastle disease. Federal: Area Veterinarians in Charge (AVICS)

http://www.aphis.usda.gov/vs/area_offices.htm

State vets: <http://www.aphis.usda.gov/vs/sregs/official.html>

Quarantine and Disinfection

Recommendations for the control and eradication of Newcastle disease include strict quarantine, slaughter and disposal of all infected and exposed birds, and disinfection of the premises. The reintroduction of new birds should be delayed for 30 days. Pests such as insects and mice should be controlled, human traffic should be limited, and the introduction of new animals with unknown health status should be avoided. Vaccines are available, though they may interfere with testing. Effective disinfectants include the cresylics and phenolics.

Public health

People can be infected with velogenic Newcastle disease and have signs of conjunctivitis which resolve quickly, with virus shed in the ocular discharges for 4-7 days. Infected individuals should avoid direct and indirect contact with avian species during this time. Laboratory workers and vaccination crews are most at risk, with poultry workers rarely being infected. No known infections have occurred from handling or consuming poultry products.

For More Information

World Organization for Animal Health (OIE)

<http://www.oie.int>

OIE Manual of Standards

http://www.oie.int/eng/normes/mmanual/a_summry.htm

OIE International Animal Health Code

http://www.oie.int/eng/normes/mcode/A_summry.htm

USAHA Foreign Animal Diseases book

http://www.vet.uga.edu/vpp/gray_book/FAD/

References

“Newcastle Disease.” In *Manual of Standards for Diagnostic Tests and Vaccines*. Paris: World Organization for Animal Health, 2000, pp. 221-232.

“Newcastle Disease.” In *The Merck Veterinary Manual*, 8th ed. Edited by S.E. Aiello and A. Mays. Whitehouse Station, NJ: Merck and Co., 1998, pp. 1941-1942.

Beard, Charles W. “Velogenic Newcastle Disease.” In *Foreign Animal Diseases*. Richmond, VA: United States Animal Health Association, 1998, pp. 396-405.

“Newcastle Disease.” 30 Aug. 2000 *World Organization for Animal Health* 16 Oct. 2001 <http://www.oie.int/eng/maladies/fiches/a_A060.htm >